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Abstract

NEUTRON THERMALIZATION AND SPECTRA

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The investigation of the neutron spectra in thermal reactors is taking an increasing importance due to the role played in them by Plutonium. Whatever the absorption law, it has been remarked that the scattering law in the moderator affects the spectrum only through certain overall properties. It would thus seem possible to develop a simplified representation of this effect which would lead to a clear understanding of the phenomena, reducing at the same time the volume of numerical calculations required.

The "synthetic" model employed by the authors presents the advantage of reducing the determination of the spectra in an homogeneous medium to the resolution of a second order differential equation, like the Wigner-Wilkins model (monoatomic gaseous hydrogen) and the "generalized heavy gas" model of J. Horowitz, which, incidentally, are both special cases. The model is, on the other hand, sufficiently general to allow a correct treatment of the situations met with in practice and in particular the important case where the presence of Plutonium introduces absorption resonances at low energy. Actually, the che-

mical or crystalline bonds of the moderator are introduced into the proposed model through two energy functions. These functions have been adjusted for the usual moderators (Graphite, heavy water, light water) by means of known theoretical scattering laws.

In a heterogeneous medium, the most important factor is the mean spectrum in the fuel of one cell, the knowledge of which is allowed by a generalization of the Amouyal-Benoist-Horowitz method. The proposed model lends itself particularly well to such calculations and also allows the effects of re-thermalization (for instance when the cooling system and the moderator are at different temperatures) to be treated.

Finally, some examples are given of practical applications : codes for spectra and effective cross sections computations (editing of tables), codes for the treatment of neutron balance in a lattice or for the interpretation of experiments (spectral indices critical experiments on plutonium, diffusion parameters).